Geophysical Research Abstracts
Vol. 16, EGU2014-8245, 2014
EGU General Assembly 2014

Madden Julian Oscillation signal in South America monsoon precipitation and its teleconnections

Alice Grimm
Federal University of Paraná, Physics, Curitiba, Brazil (grimm@fisica.ufpr.br, 55 41 3361-3418)

The impact of the Madden Julian Oscillation (MJO) on the summer monsoon precipitation in South America is assessed with unprecedented temporal and spatial coverage. The anomalies in daily precipitation and in the frequency of its extreme events are calculated for each of the MJO phases using daily gauge station data. These anomalies are shown to be produced by tropics-tropics and tropics-extratropics teleconnections. Besides, teleconnections are detected between intraseasonal precipitation anomalies in South America and southern Africa. The daily rain gauge station data in the period 1979-2009 are gridded to 1 degree, and submitted to a bandpass Lanczos filter, which retains intraseasonal oscillations in the 20-90 day band. The main modes of rainfall variability in this time scale are consistent with the anomalies during the different phases of the MJO. These phases are determined through indices based on the first two empirical orthogonal functions of the combined fields of zonal wind at 850 hPa and 200 hPa and OLR, between 15S e 15N, after removal of the annual cycle and interannual variability. Composites of anomalies in precipitation and in the frequency of extreme events are made for each phase, and their significance is assessed. The associated composites of global streamfunction, velocity potential, and OLR anomalies give insights on the mechanisms of the impact. Teleconnections responsible for the impact are searched with the help of influence functions of a vorticity equation model that includes the divergence of the basic state and the advection by anomalous divergent wind. The influence functions are calculated for the action centers of an anomalous streamfunction wavetrain associated with the highest impact on South America, and indicate regions in which upper level anomalous divergence associated with anomalous tropical convection is most efficient in producing the observed wavetrain. The major source region contains significant MJO-related OLR anomalies in the central subtropical southern Pacific, whose timing is consistent with that of the highest impact over South America.
Simulations with the vorticity equation model confirm the remote influence by reproducing the observed wavetrain. Tests with different forcings corresponding to different convection anomalies observed previously to the major impact over South America confirm that the strongest remote influence comes from the major source region indicated by the influence functions, despite the existence of more intense convection anomalies in other regions.
Acknowledgments: CNPQ-Brazil (Program Pro-Africa), CLARIS-LPB Project FP7/2007-2013).